



Phosphorus Trends in the Everglades

Governing Board Meeting – March 12, 2015

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Presentation Outline

- Phosphorus Requirements in the Everglades
- Overview of Phosphorus Trends in the Everglades
- The Changing System with Mod Waters & CEPP



Phosphorus Requirements in the Everglades

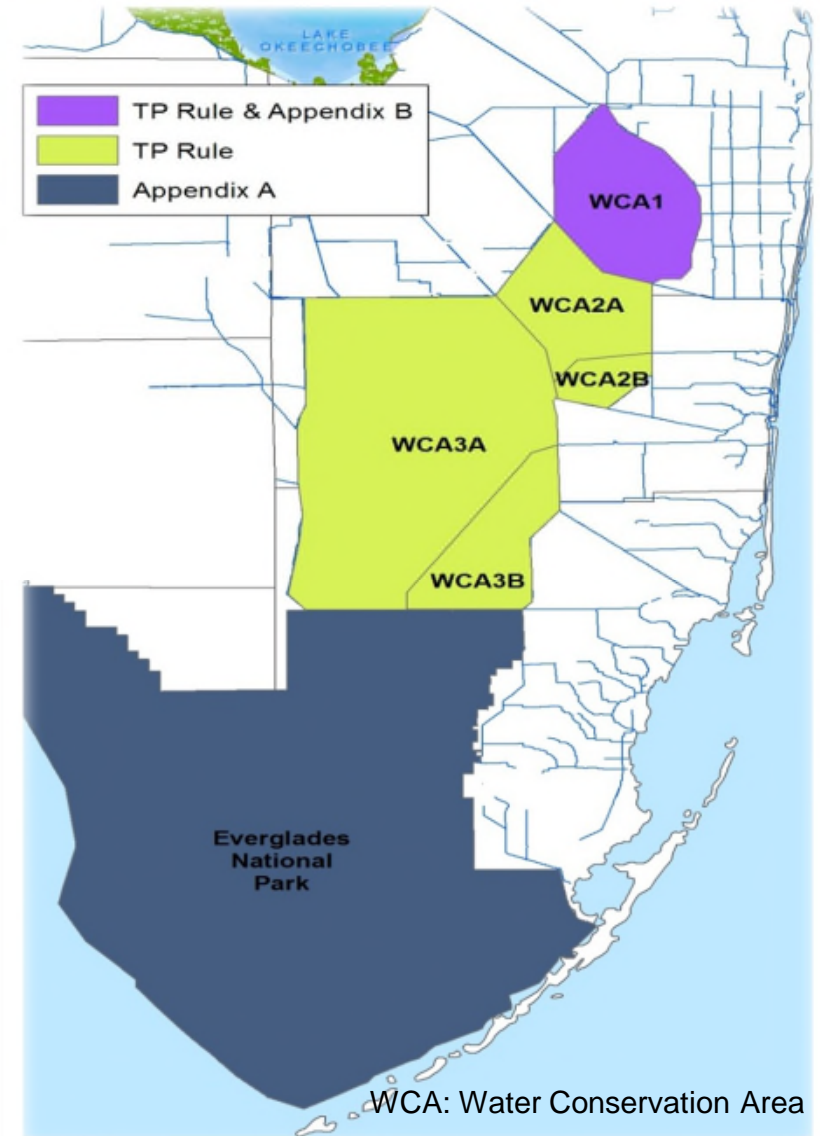


Phosphorus Requirements for the Everglades Protection Area

- Maintenance of state water quality standards is crucial to the ecology of the WCAs and Everglades National Park
- Legal requirements to reduce phosphorus levels in discharges and achieve water quality standards
 - 1992 (and amendments) Settlement Agreement/Consent Decree (Appendix A/B)
 - 1994 (and amendments) Everglades Forever Act
 - Numeric phosphorus criterion throughout the EPA marsh/WQBELS

Settlement Agreement & State Phosphorus Requirements

- WCA-1 (Refuge)
 - Settlement Agreement Appendix B, and
 - State Phosphorus Rule (10 ppb)
- WCA-2 & WCA-3
 - Settlement Agreement does not apply
 - State Phosphorus Rule (10 ppb)
- Everglades National Park
 - Settlement Agreement Appendix A (Appendix A limit also adopted in state phosphorus rule)



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Phosphorus Requirements for the Everglades Protection Area

- Projects to achieve and maintain water quality standards
 - EAA & C-139 BMP Program (from 1996)
 - STAs (1994 – 2012)
 - Restoration Strategies Expanded STA/FEB (from 2013)
- Integration with Federal projects (Modified Water Deliveries) and CERP projects (CEPP)

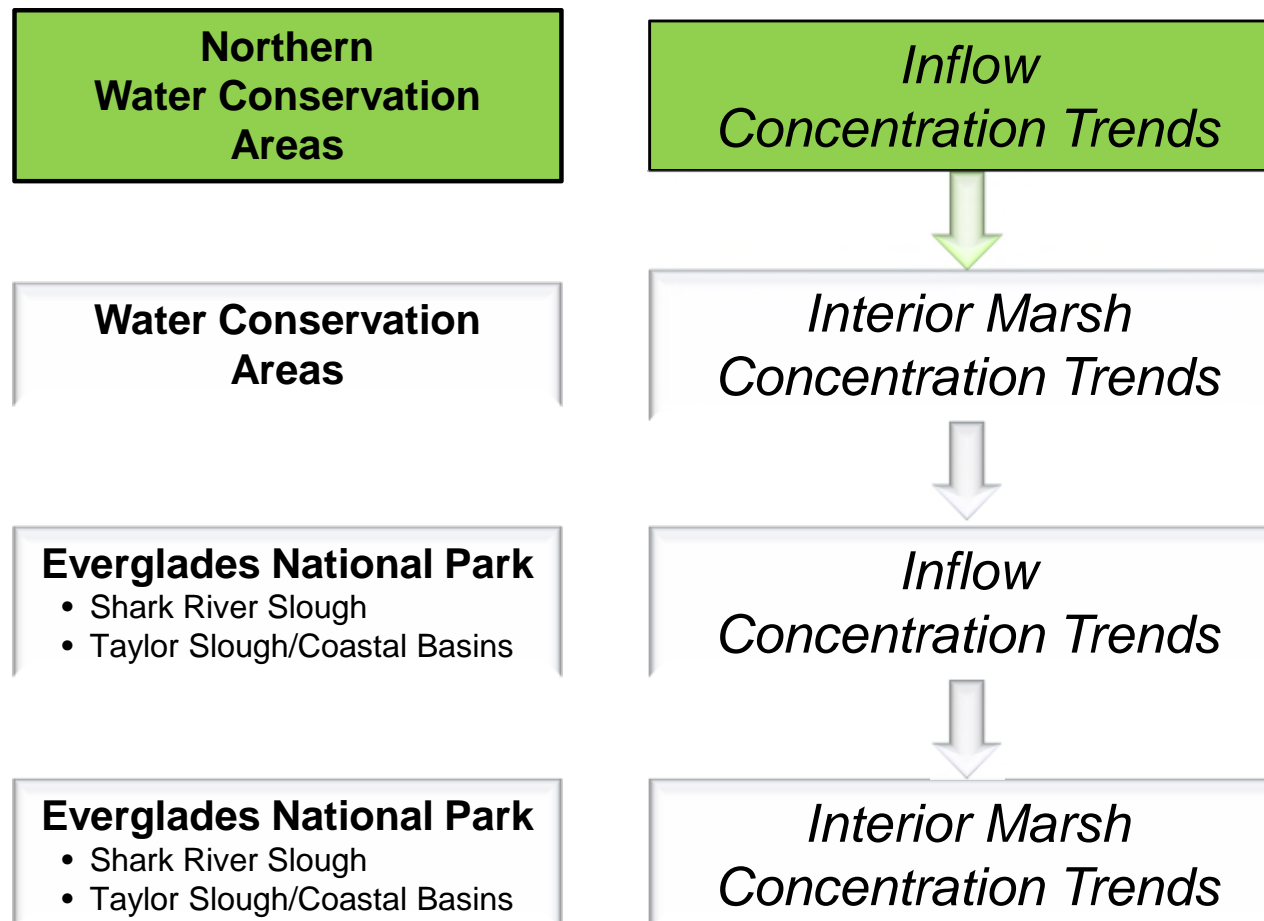


Overview of Phosphorus Trends in the Everglades

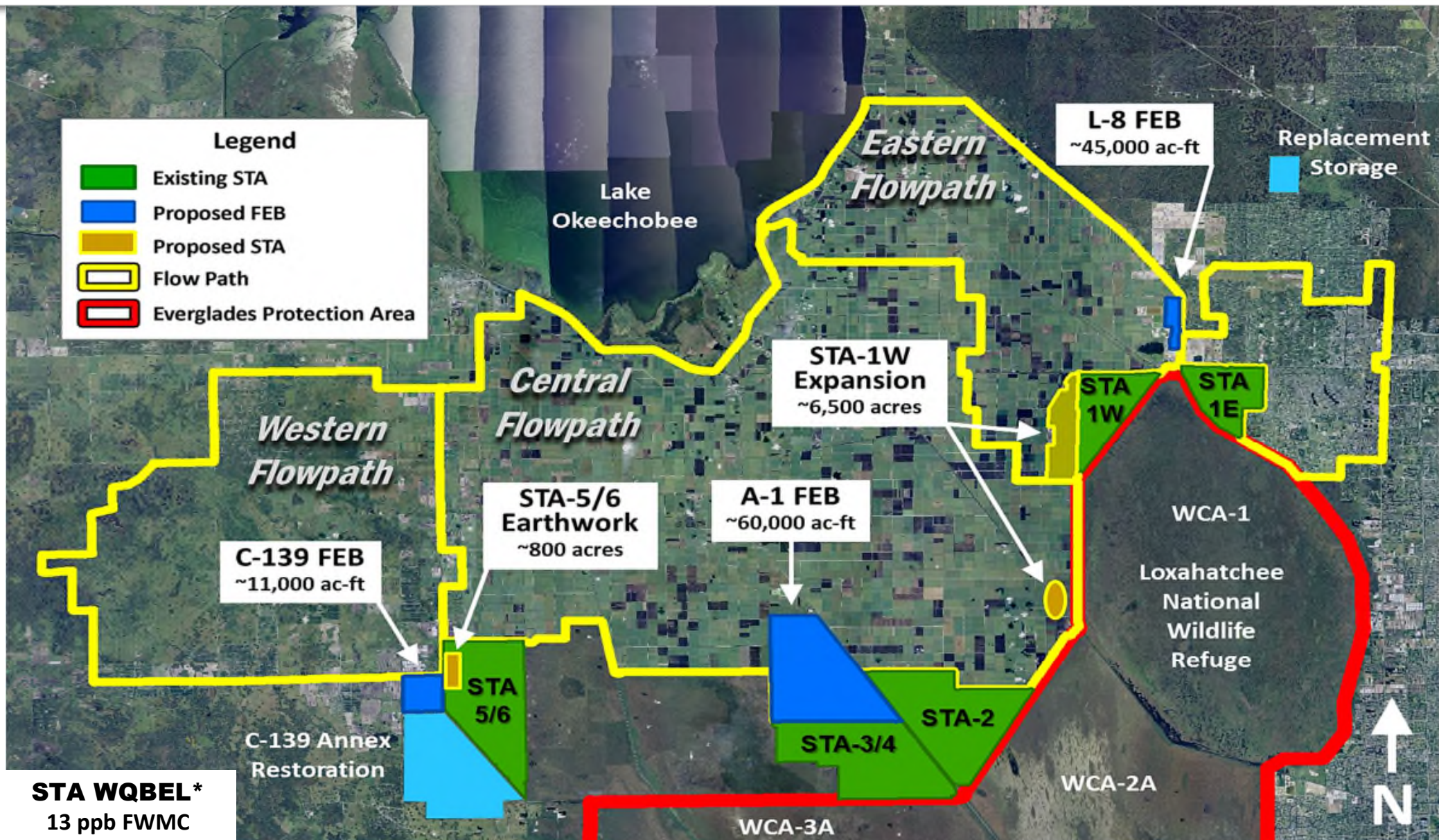


Phosphorus Trends in the Everglades Protection Area

Overview

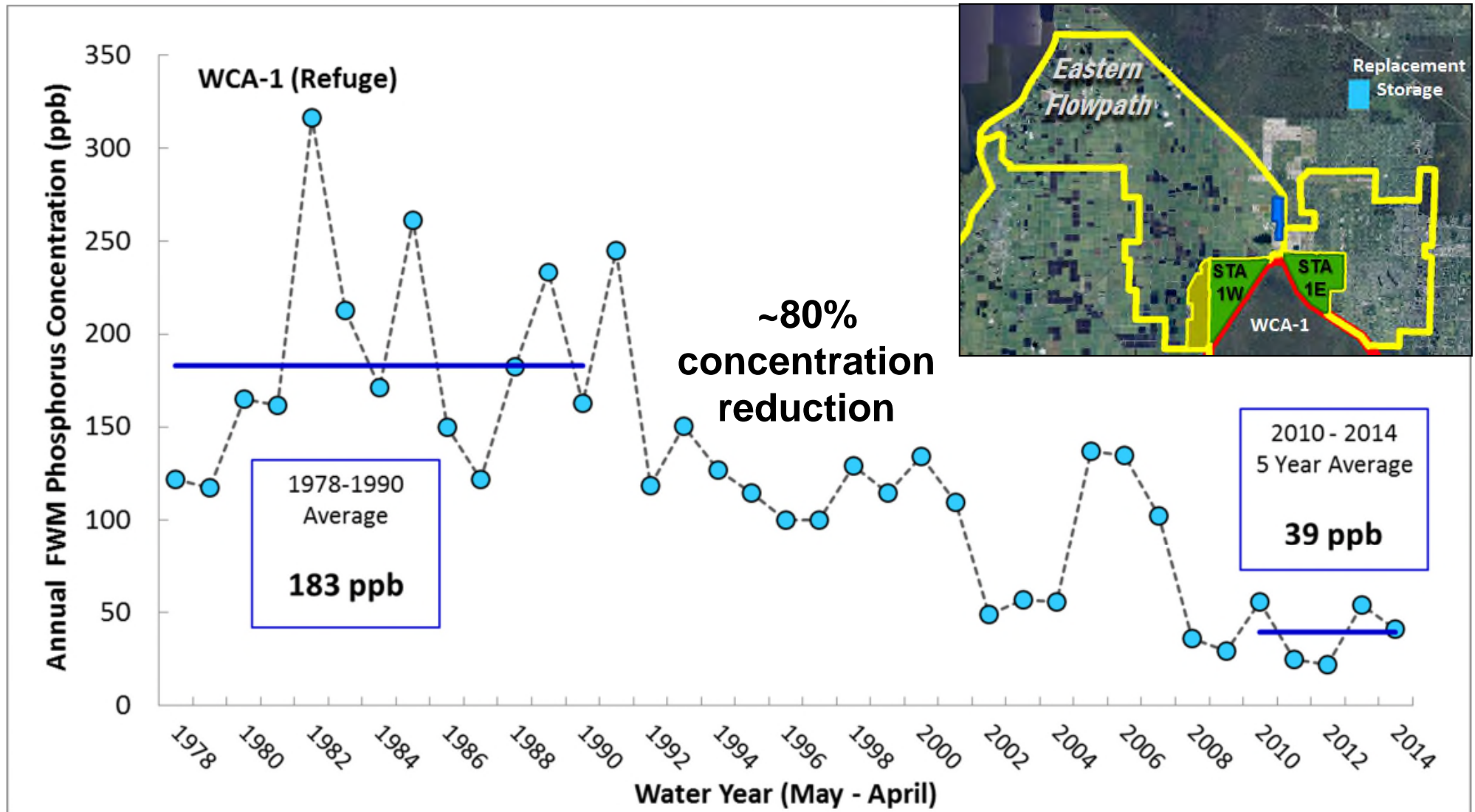


Inflows to the Northern Water Conservation Areas



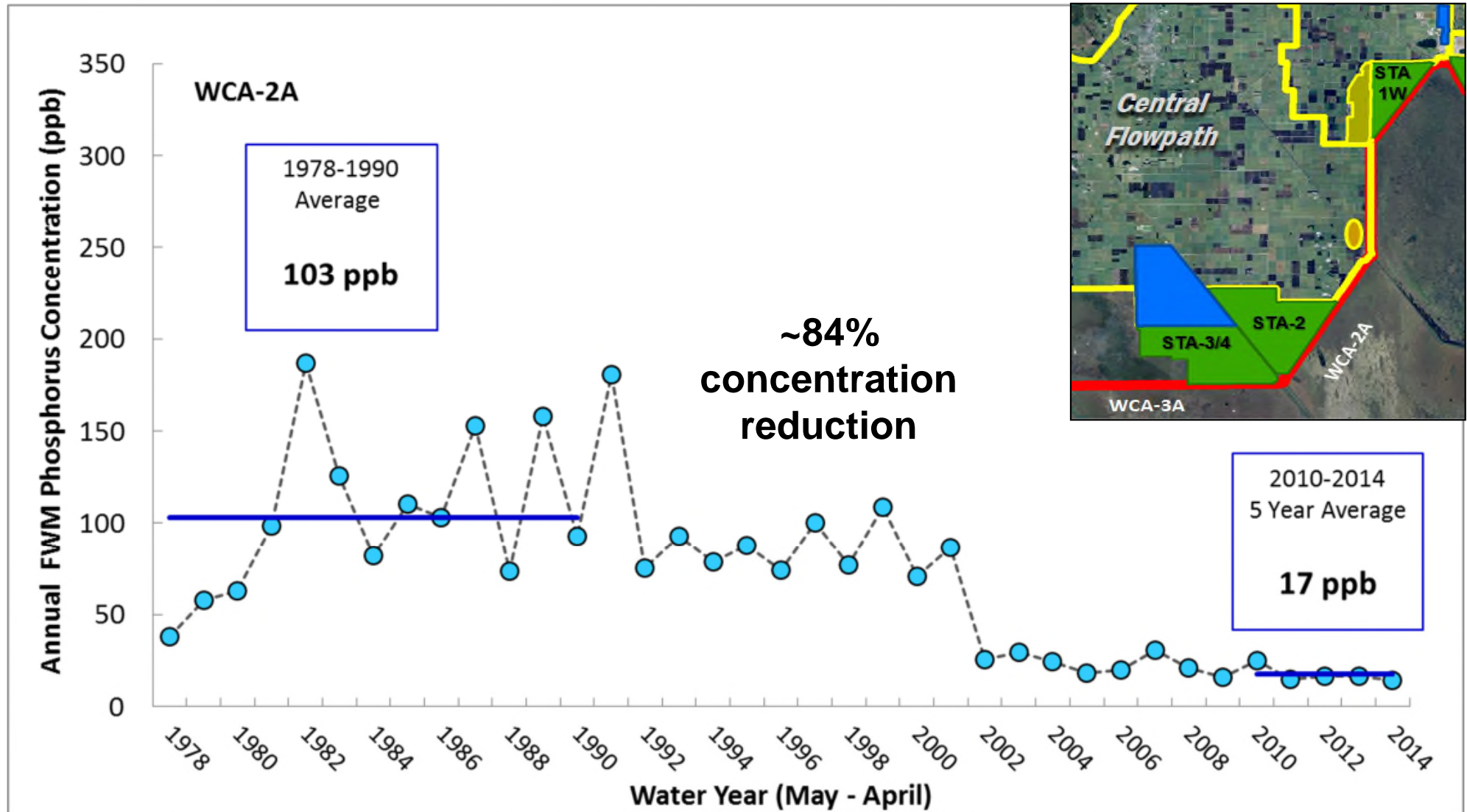
*WQBEL – water quality based effluent limit; FWMC – flow weighted mean concentration

Water Conservation Area 1 (Refuge) Inflow Phosphorus Concentration Trends



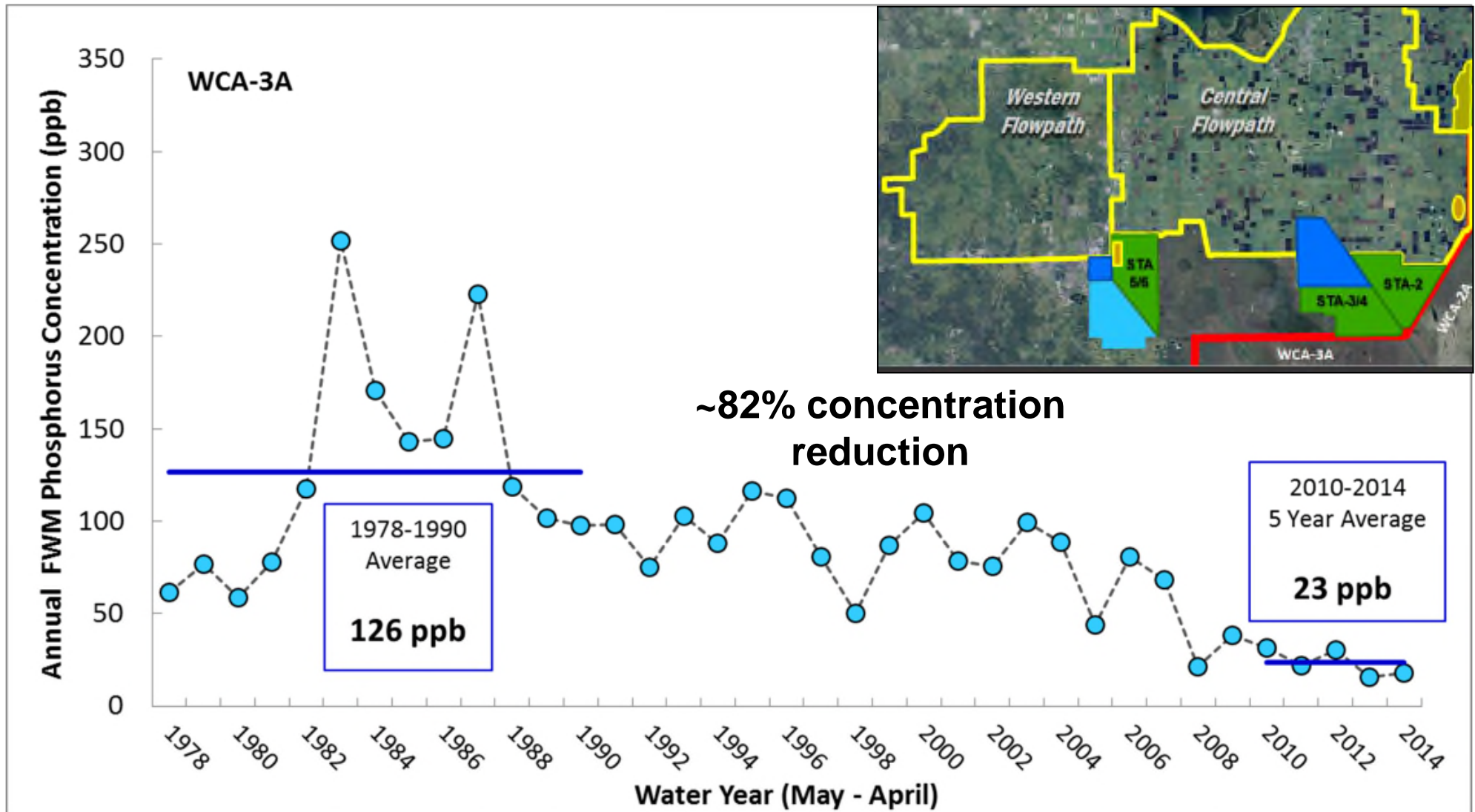
FWMC – flow weighted mean concentration BMPs – Best Management Practices

Water Conservation Area 2A Inflow Phosphorus Concentration Trends



FWMC – flow weighted mean concentration

Water Conservation Area 3A Inflow Phosphorus Concentration Trends

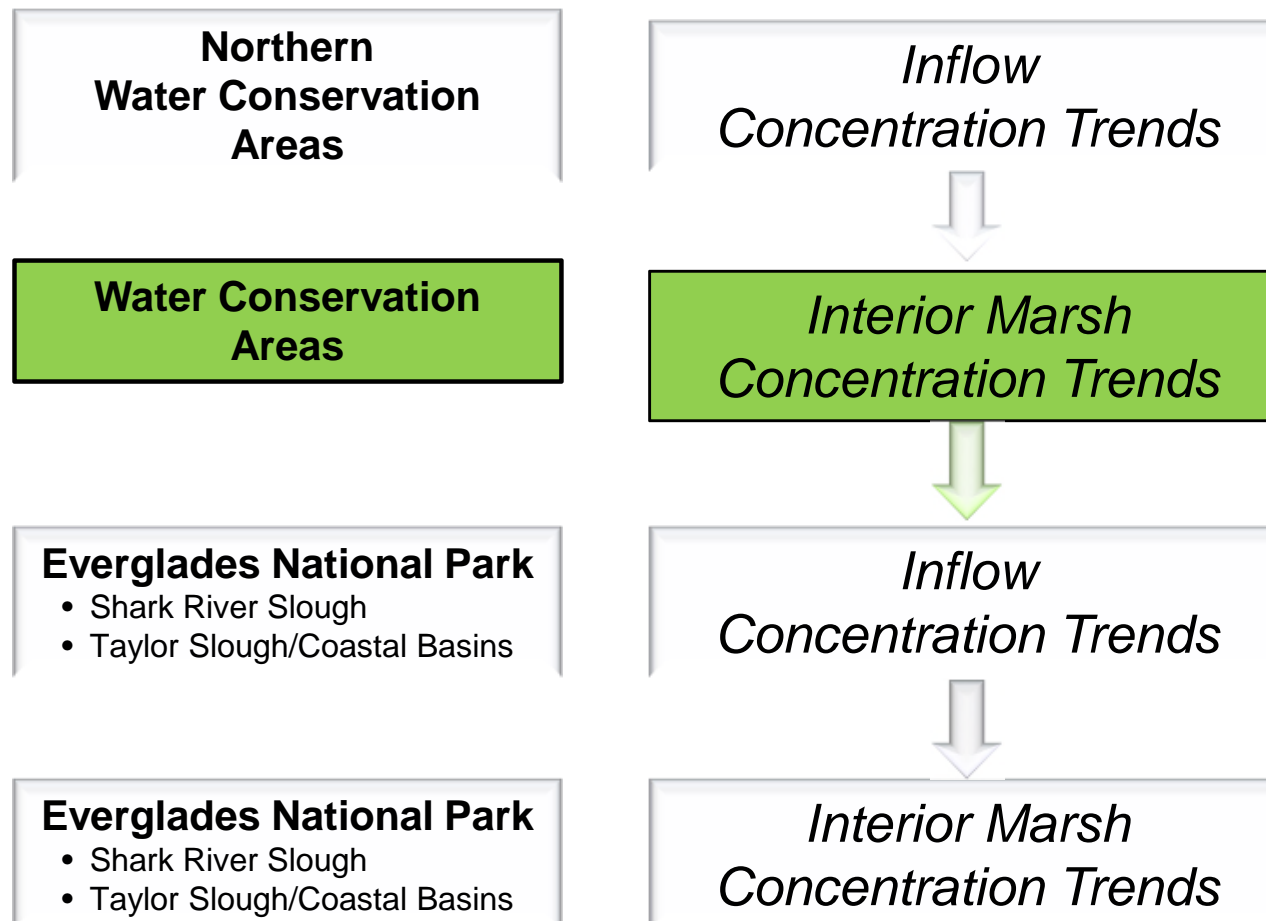


FWMC – flow weighted mean concentration BMPs – Best Management Practices

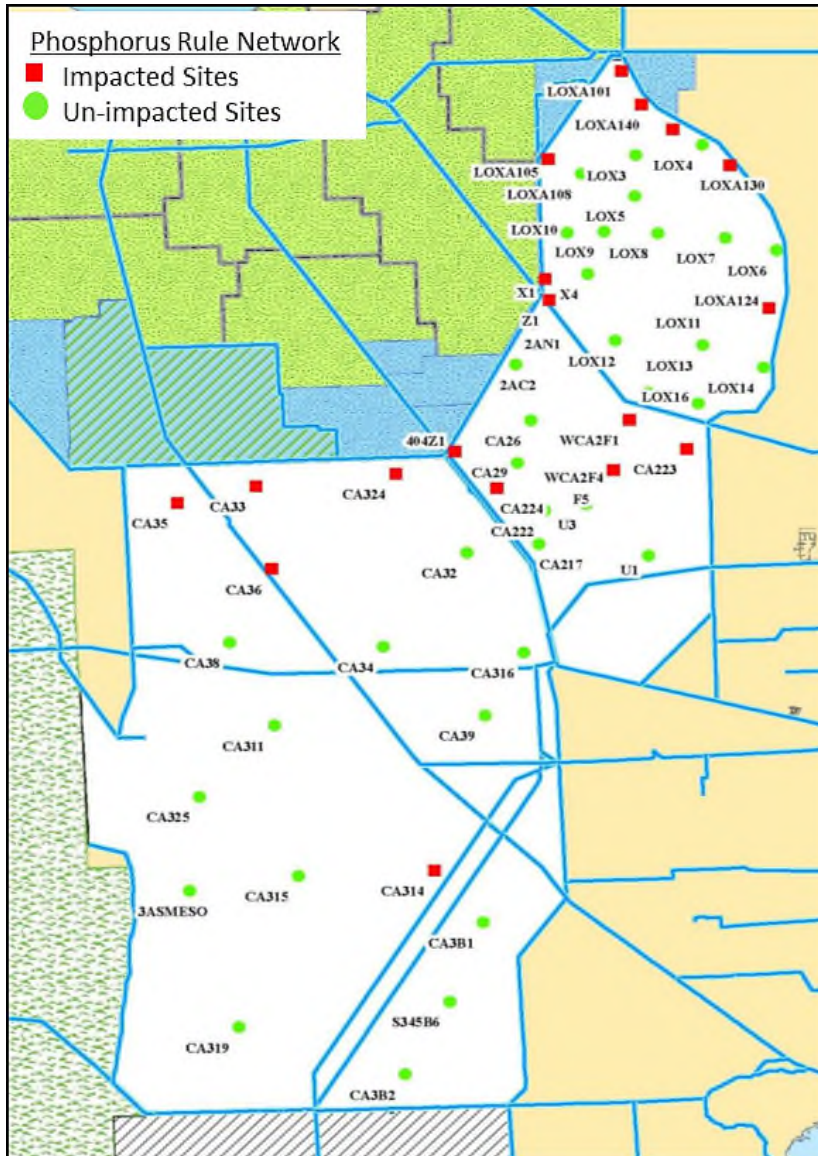


Phosphorus Trends in the Everglades Protection Area

Overview



Water Conservation Areas Marsh Phosphorus Trends



■ WCA-1 (Refuge)

• Settlement Agreement, Appendix B

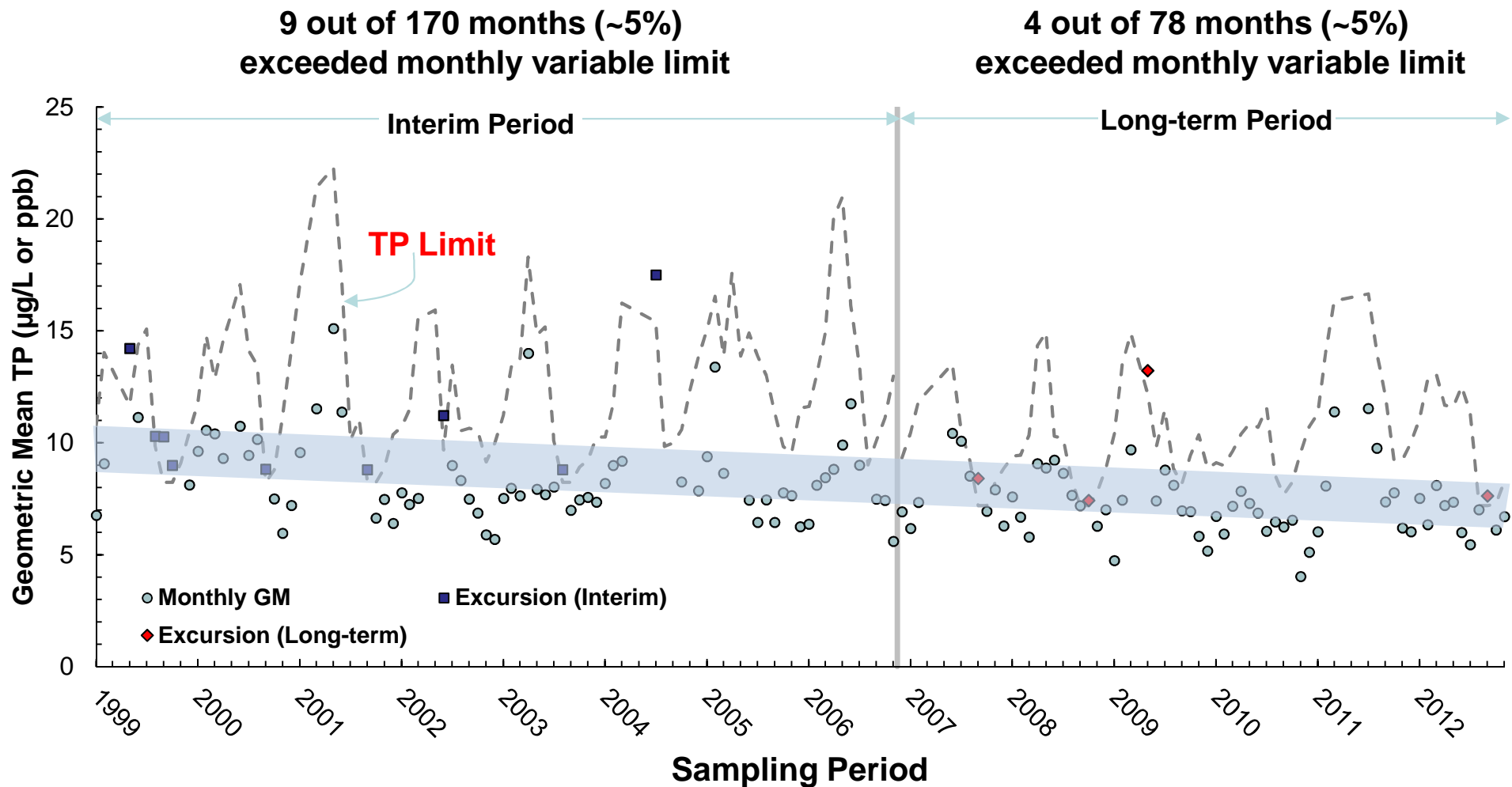
- Long-term Limit: Concentration varies with Stage (inverse relationship)
- Achievement:
 - Varies 7.2 ppb – 17.6 ppb (geometric mean)
 - No more than 1 in 12 months can exceed limit

■ All WCAs

• State Phosphorus Rule

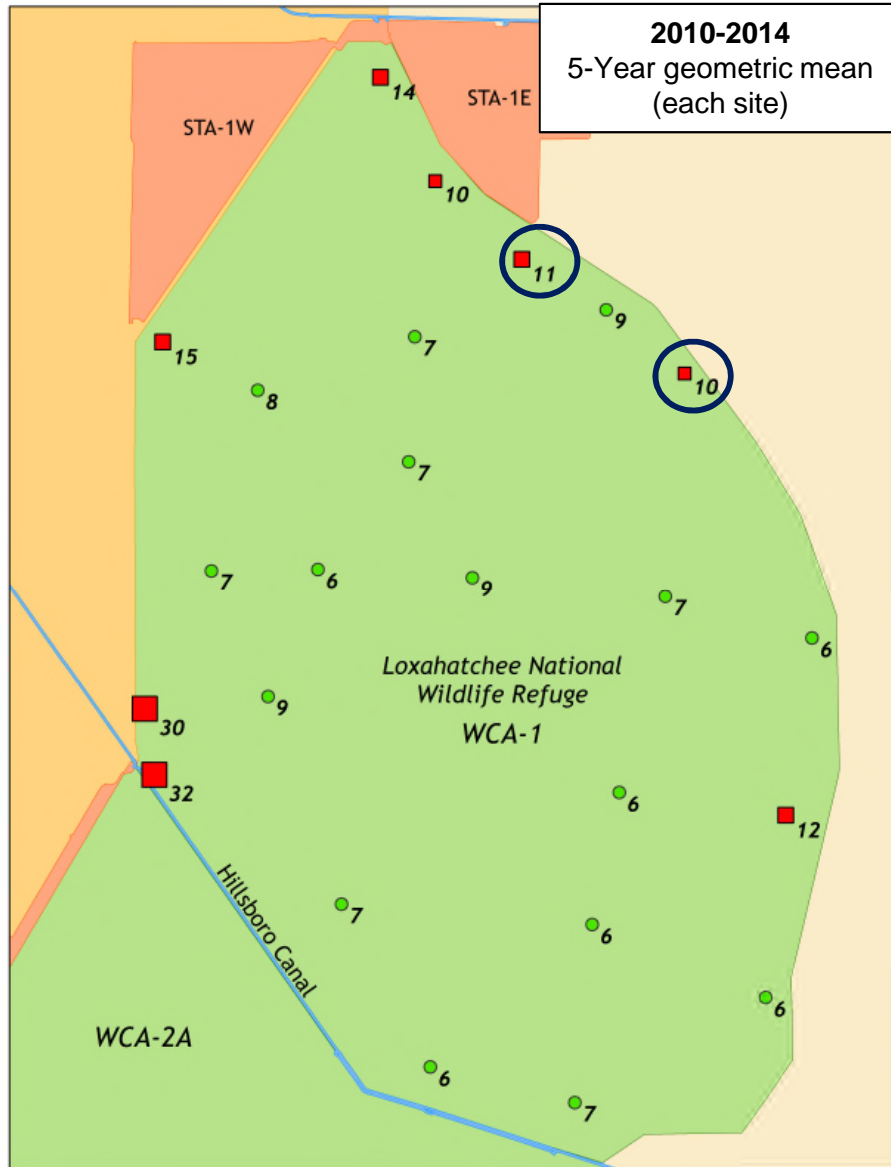
- “Impacted” and “Un-impacted” network of sites (separately assessed)
- Long-term Criterion: 4-Part Test
- Achievement in each WCA:
 - Do not exceed 5-yr average 10 ppb (geometric mean)
 - Do not exceed 3 other spatial / temporal related tests

Water Conservation Area 1 (Refuge) Settlement Agreement – App. B / Interior Marsh Trends



TP concentrations from 14 Interior Refuge marsh sites used to determine Appendix B achievement

WCA-1 (Refuge) State TP Rule / Interior Marsh Trends



2010 - 2014 Network Average

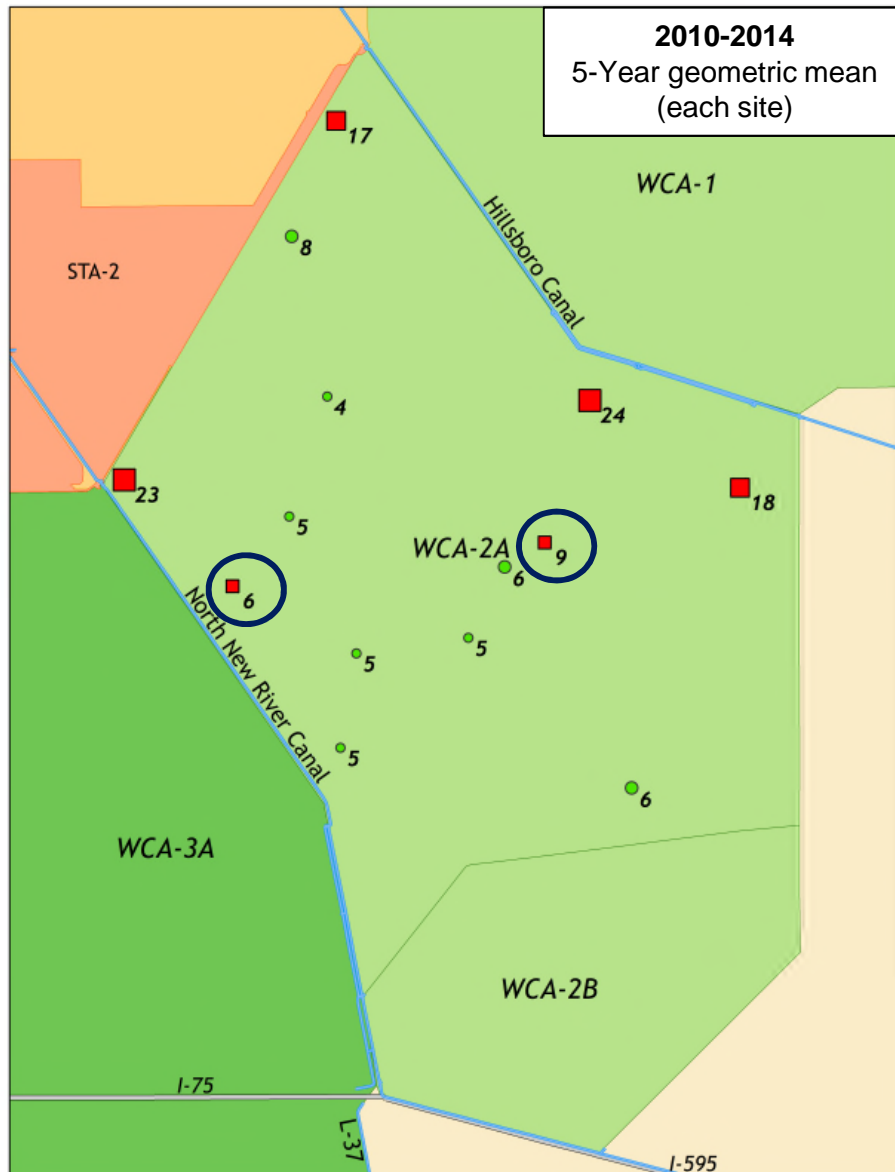
■ Impacted
5-yr GM = 18 ppb
 Range = 15 - 24 ppb

● Un-Impacted
5-yr GM = 7 ppb
 Range = 7 - 8 ppb

GM = geometric mean
 Range = annual average

WCA-2A

State TP Rule / Interior Marsh Trends

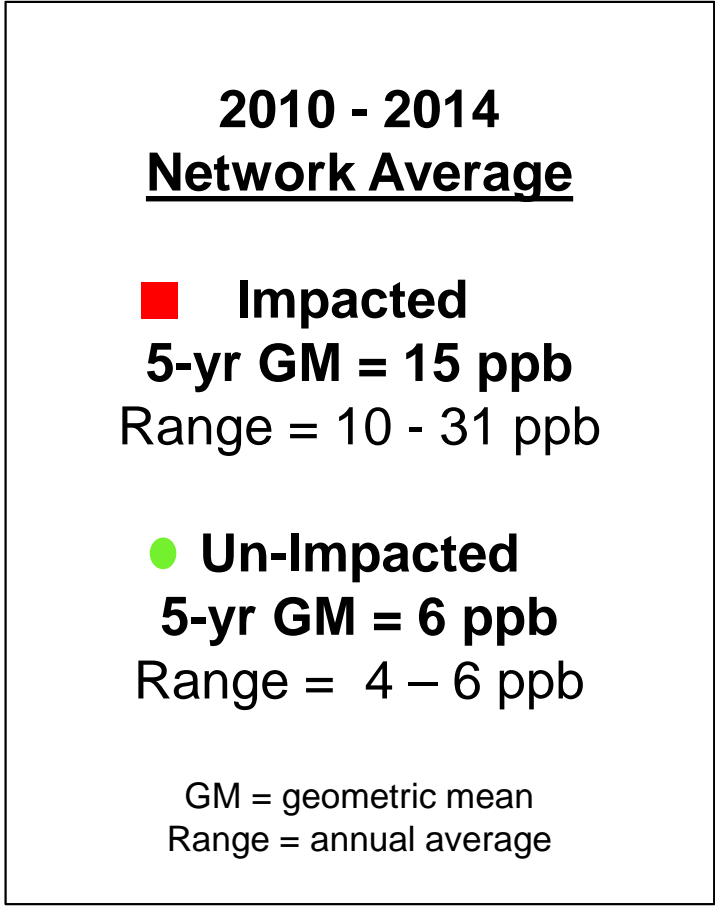
**2010 - 2014
Network Average**

■ **Impacted**
5-yr GM = 20 ppb
Range = 15 - 24 ppb

● **Un-Impacted**
5-yr GM = 6 ppb
Range = 5 - 6 ppb

GM = geometric mean
Range = annual average

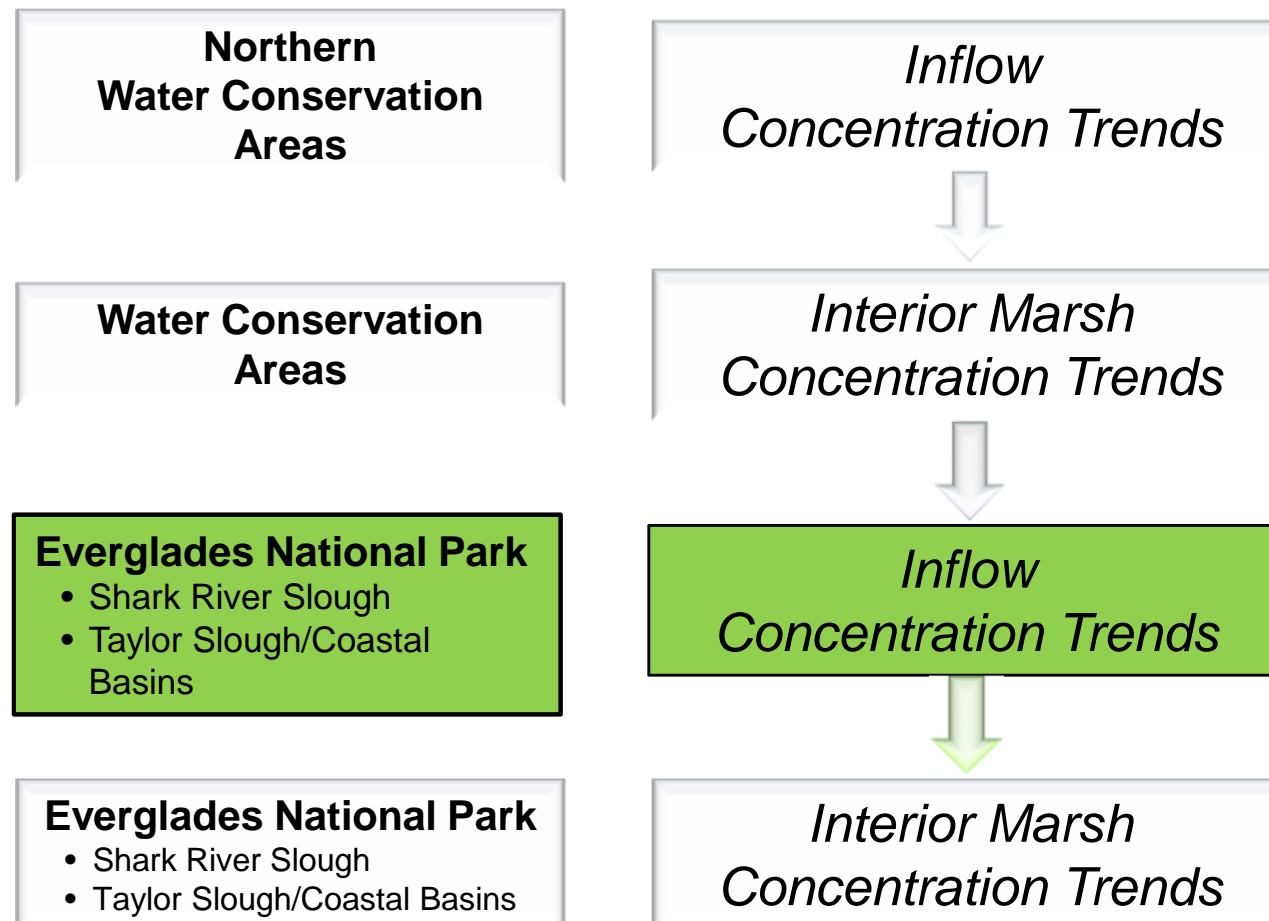
State TP Rule / Interior Marsh Trends





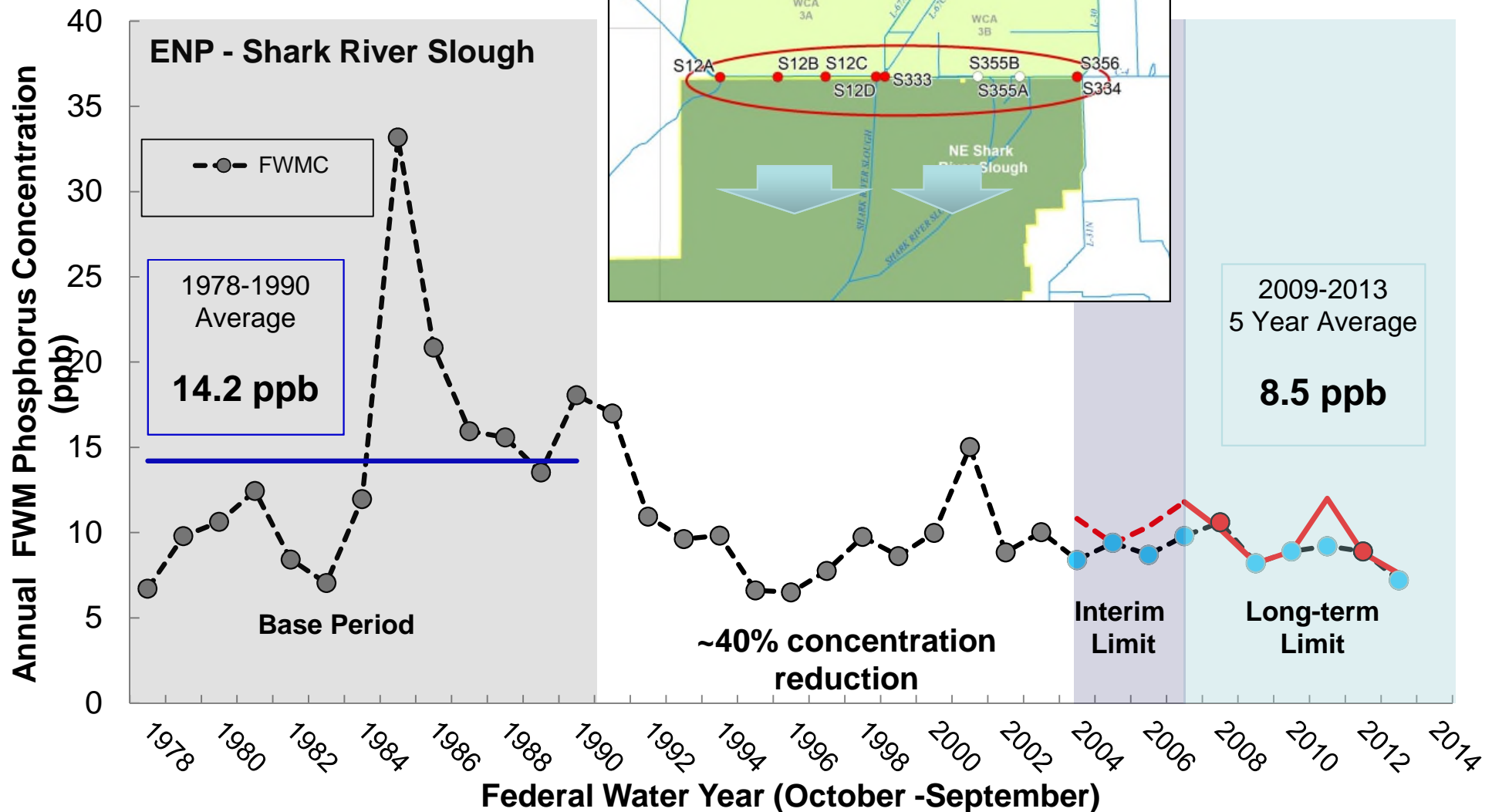
Phosphorus Trends in the Everglades Protection Area

Overview



Shark River Slough

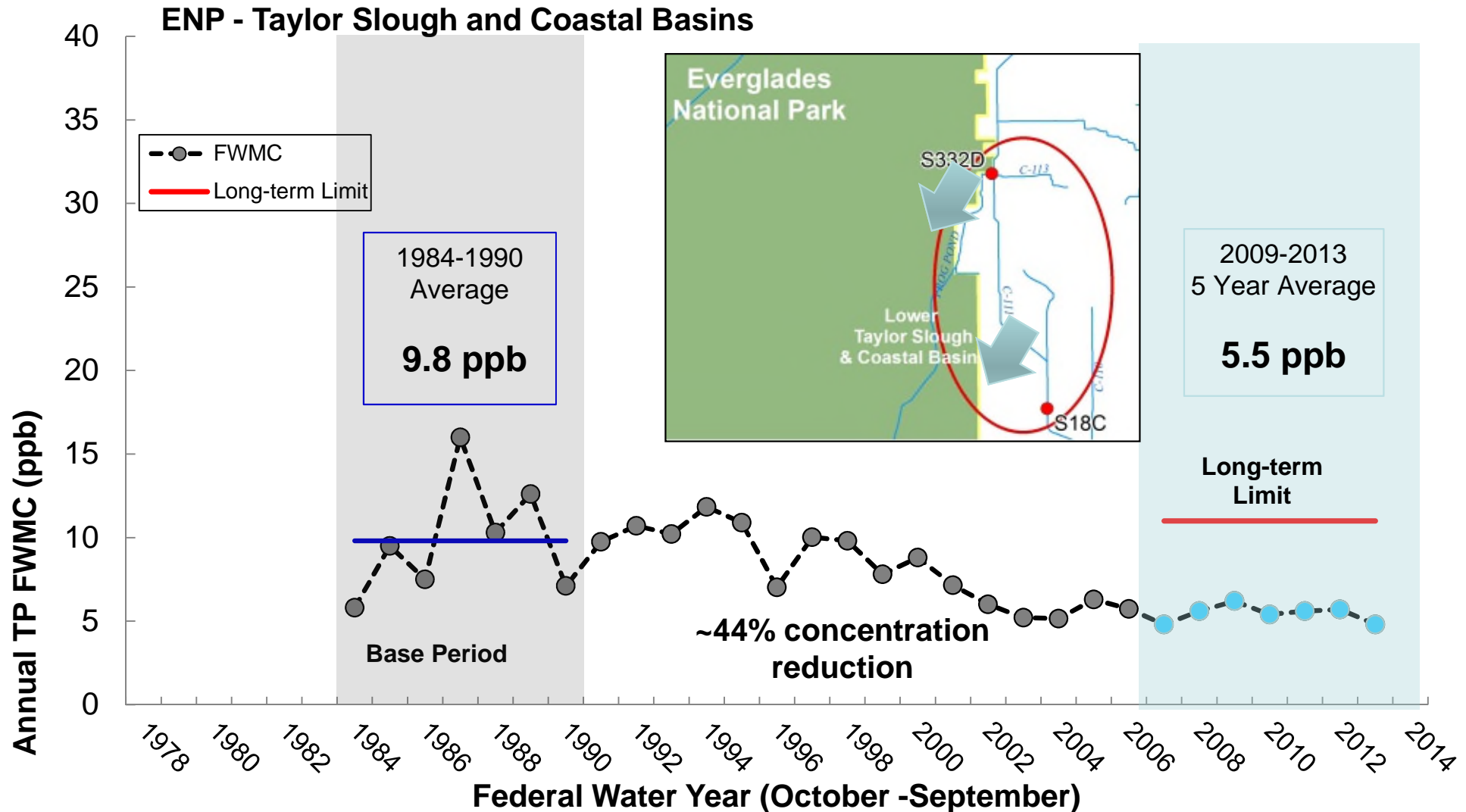
Appendix A – Inflow Phosphorus Trends



FWMC – flow weighted mean concentration

Taylor Slough & Coastal Basins

Appendix A – Inflow Phosphorus Trends

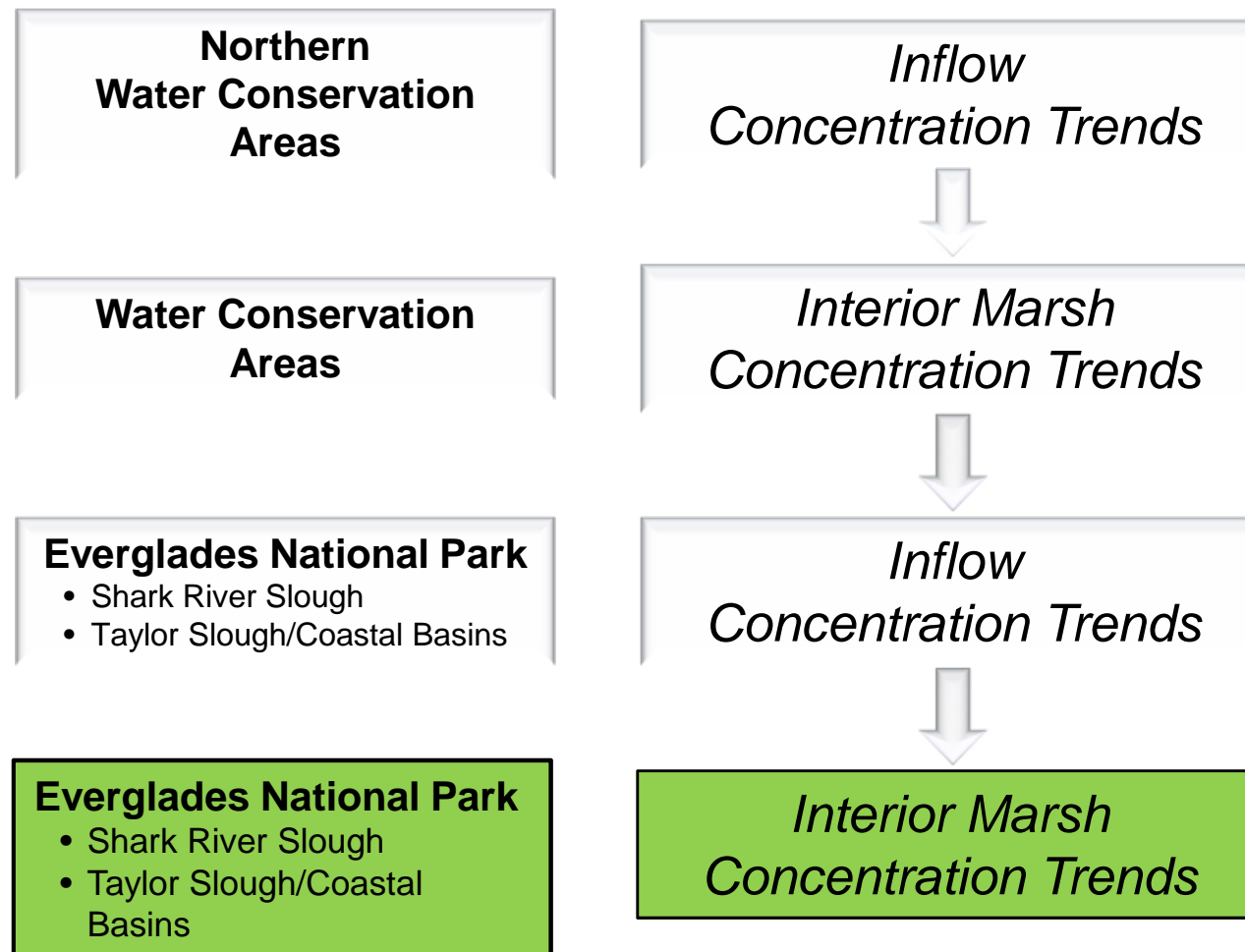


FWMC – flow weighted mean concentration

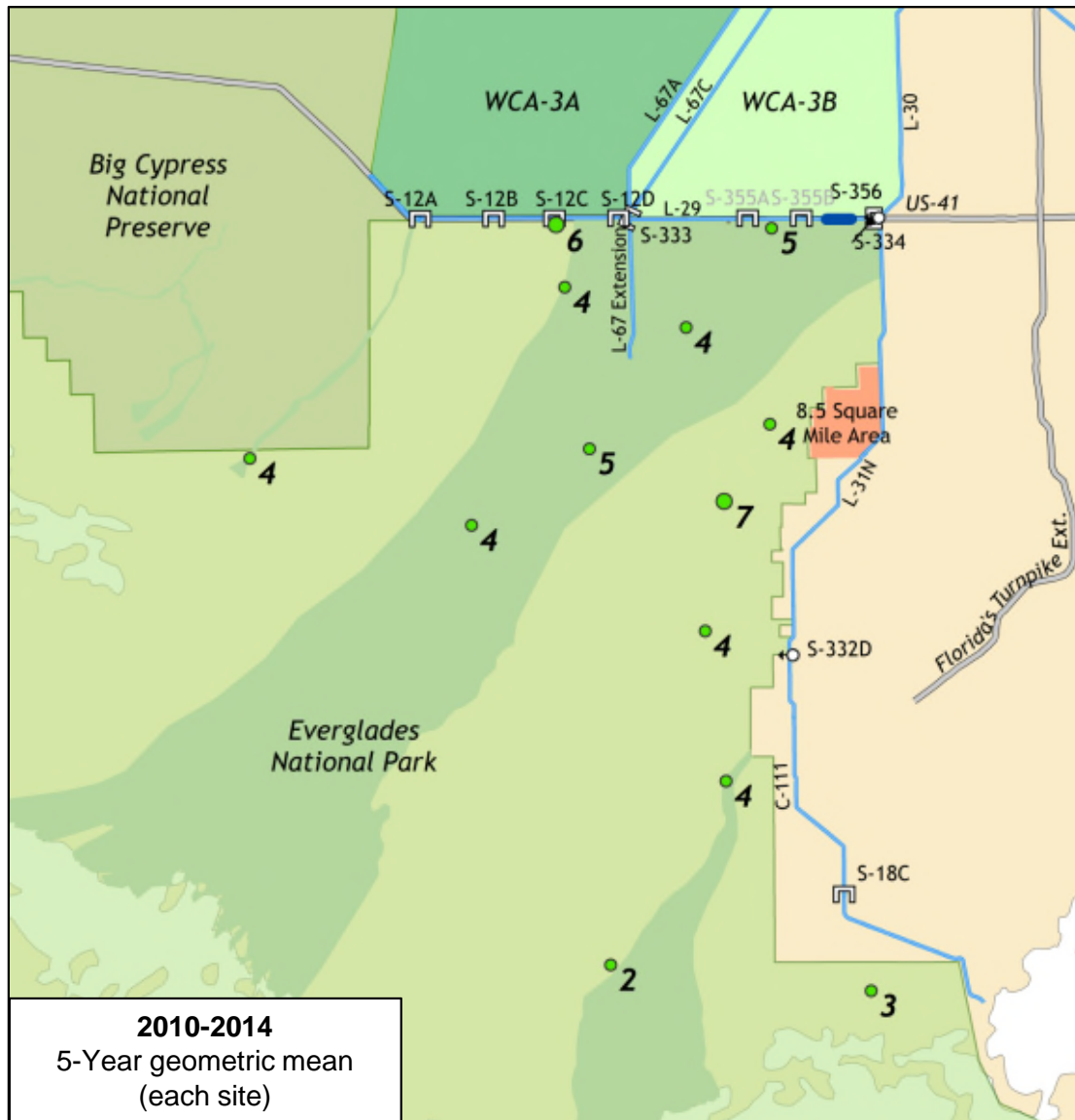


Phosphorus Trends in the Everglades Protection Area

Overview



Everglades National Park Marsh Phosphorus Trends



2010 - 2014 Network Average

Shark River Slough

● **Un-Impacted**
5-yr GM = 6 ppb
Range = 4 – 7 ppb

Taylor Slough/Coastal Basins

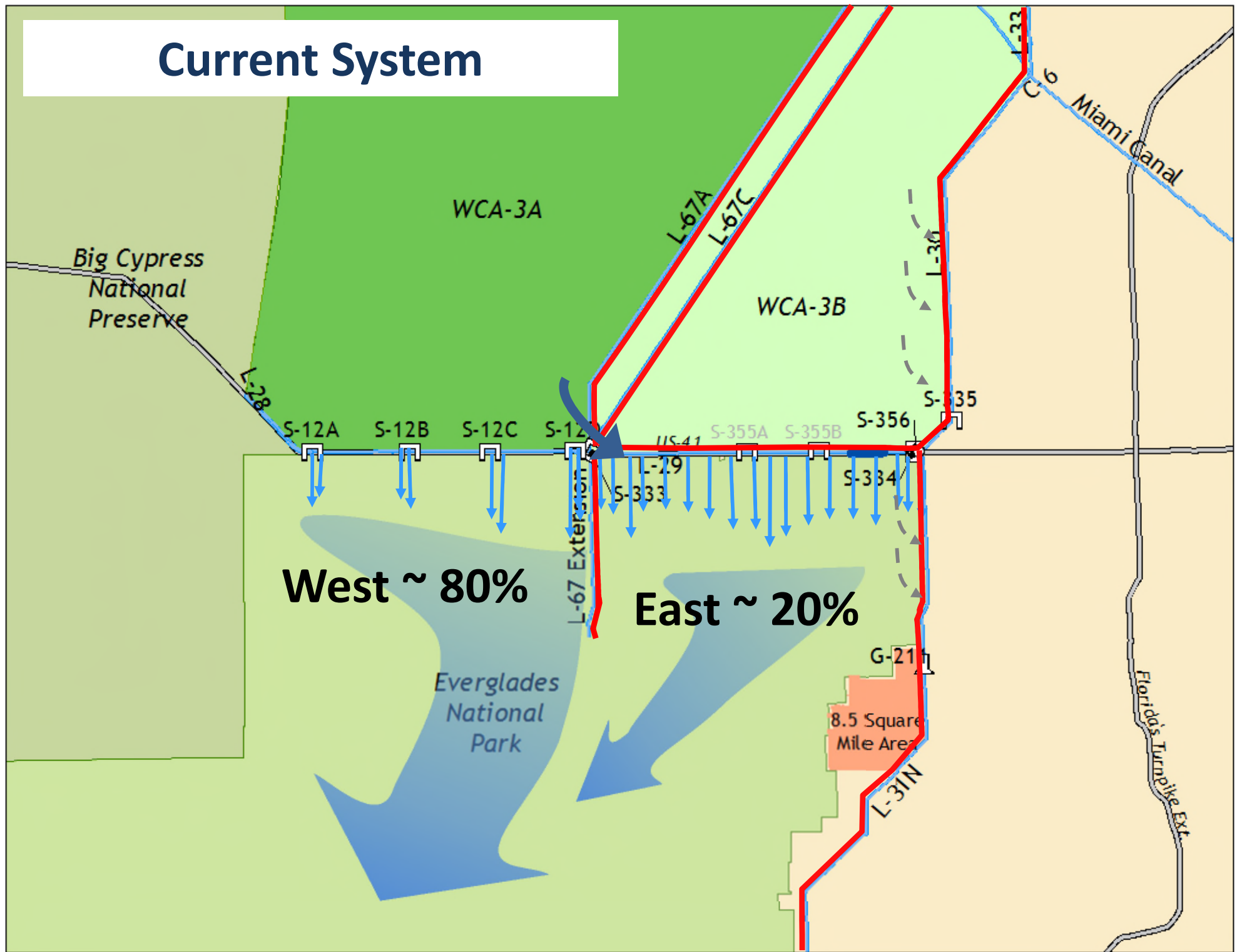
● **Un-Impacted**
5-yr GM = 4 ppb
Range = 3 – 5 ppb

GM = geometric mean
Range = annual average

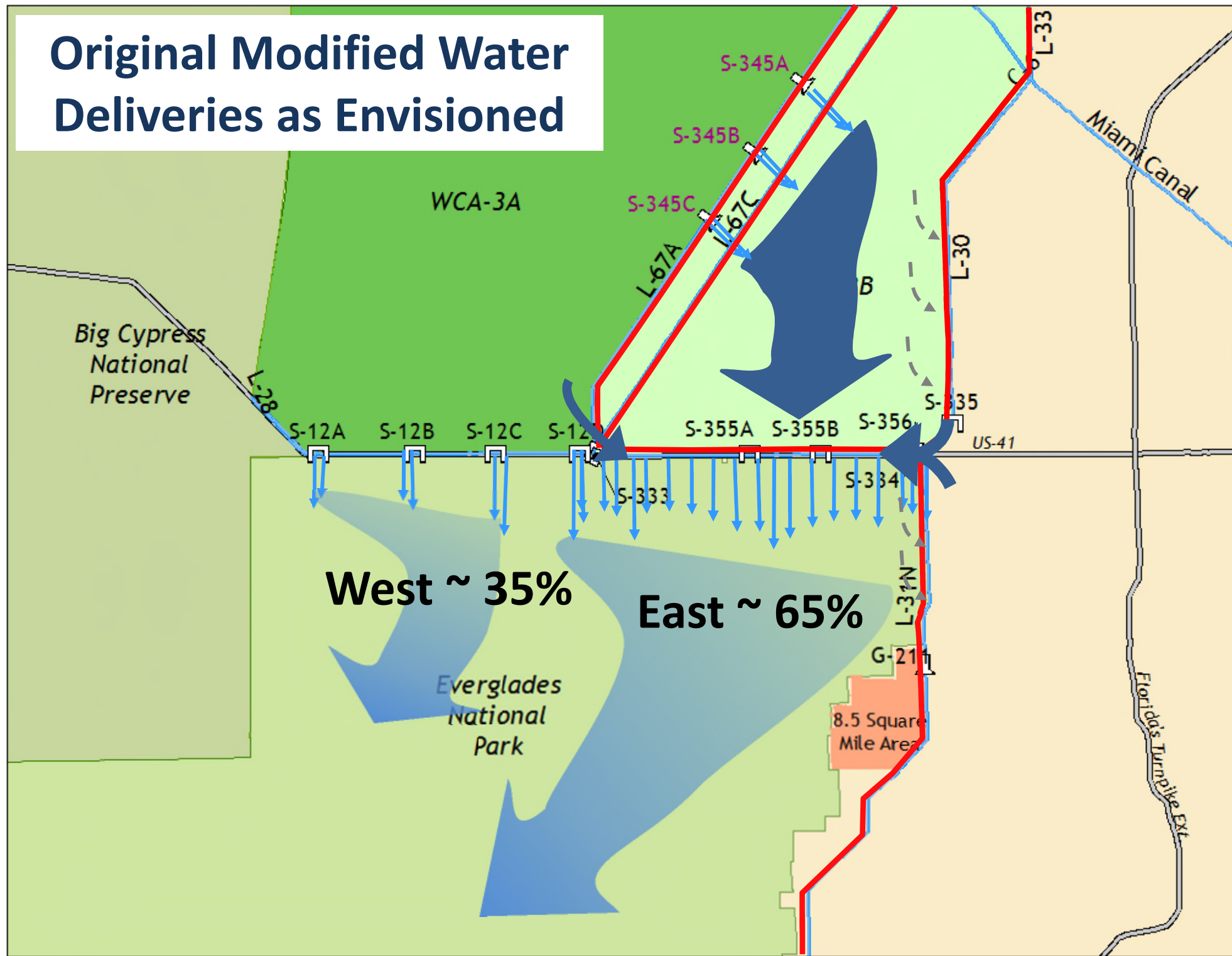


The Changing System with Mod Waters & CEPP

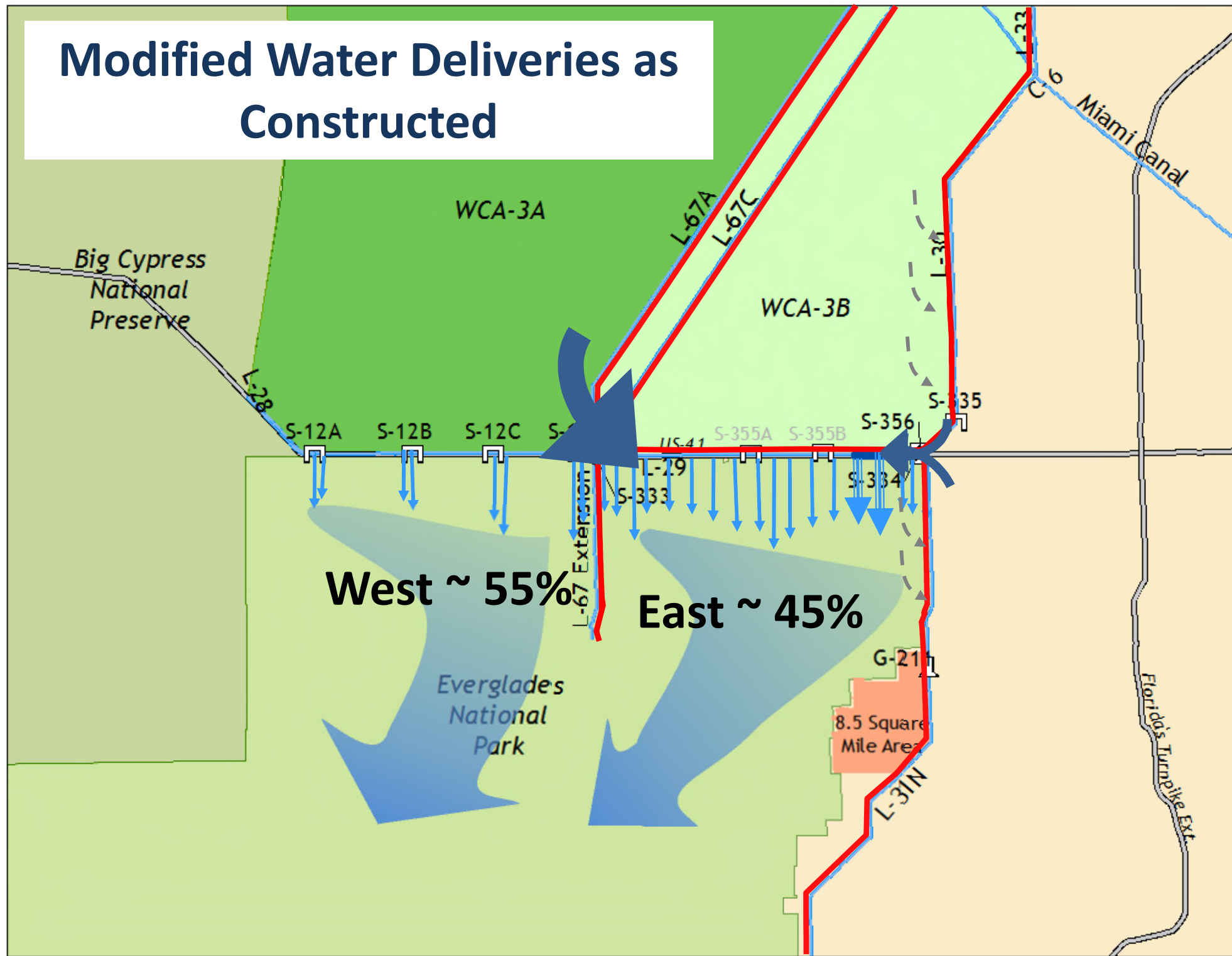
Current System



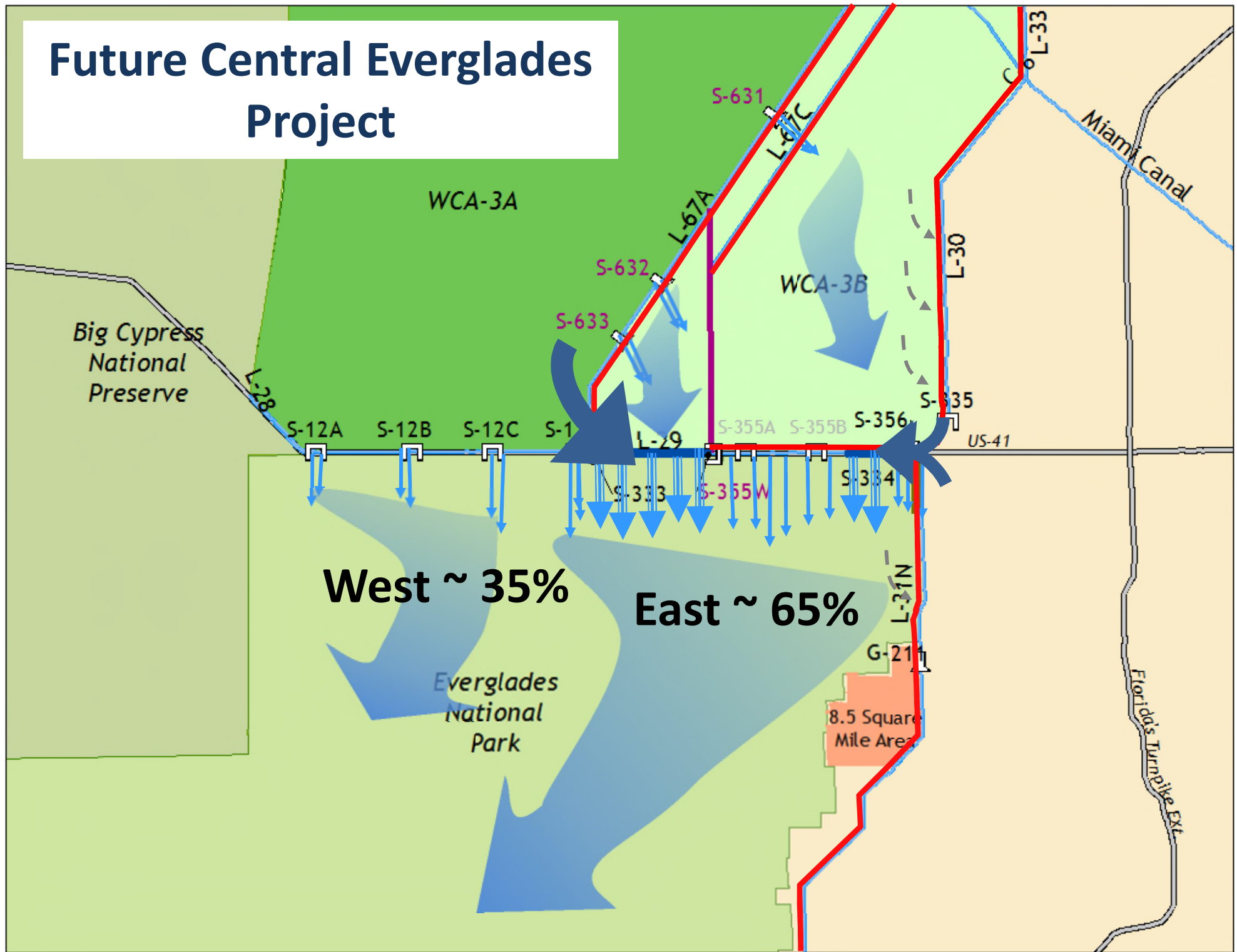
Original Modified Water Deliveries as Envisioned



Modified Water Deliveries as Constructed



Future Central Everglades Project





Conclusions and Path Forward

- Inflow TP is low, yet sensitive to hydrology, wet/dry seasons and climatic cycles
- TP also varies with flow type (marsh vs canal), location (western vs eastern SRS) and volume (increases in drier periods)
- Even small variations in TP can be important when limit is very low
- Recognize the system will continue to change over time
- Evaluation underway to consider hydrologic variability, changes in delivery system, and measurement uncertainty



Discussion